FINAL SITE INVESTIGATION AND ENGINEERING EVALUATION REPORT
for the
BOYERTOWN SANITARY DISPOSAL LANDFILL
300 MERKEL ROAD
GILBERTSVILLE, PENNSYLVANIA 19525

PADEP CONTRACT NO. ME-359186
PADEP REQUISITION NO. 30-174

Prepared for:

Commonwealth of Pennsylvania
Department of Environmental Protection
Southeast Office
Two East Main Street
Norristown, PA 19041

United States Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2039

JUNE 2004

Tetra Tech FW, Inc.
One Oxford Valley – Suite 200
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NOTICE

The information in this document has been funded by the Pennsylvania Department of Environmental Protection (PADEP) under Contract No. ME-359186 to Tetra Tech FW, Inc. This document has been formally released by Tetra Tech FW, Inc. to PADEP.

FINAL SITE INVESTIGATION AND ENGINEERING EVALUATION REPORT
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1.0 INTRODUCTION

Tetra Tech FW, Inc. (TtFW) has prepared this Final Site Investigation Report for the Site Investigation and Engineering Evaluation, which was performed at the Boyertown Sanitary Disposal (BSD) Landfill for the Pennsylvania Department of Environmental Protection (PADEP) and the United States Environmental Protection Agency (USEPA), under PADEP Work Requisition Number 30-174, Contract Number ME-359186 on April 20 and 21, 2004. TtFW has incorporated USEPA and PADEP comments into the Final Report.

Major components of this field investigation included:

- Mobilization/Demobilization;
- Landfill gas monitoring at 10 existing landfill gas monitoring points;
- Landfill gas monitoring at five temporary landfill gas monitoring clusters which were installed by a TtFW subcontractor;
- Surface Water Sampling; and
- Evaluation of the operation of the gas collection system, leachate collection/treatment system, and visual inspection of the integrity of the landfill soil cover.

The purpose of this Site Investigation was to collect additional data to assist PADEP and USEPA in determining whether human exposures and groundwater releases are controlled, per the Resource Conservation and Recovery Act (RCRA) Corrective Action Program.

1.1 SITE BACKGROUND AND DESCRIPTION

The BSD Landfill is a PADEP solid waste permitted landfill, located on approximately 100 acres of land in Gilbertsville, PA, that accepted municipal waste and small amounts of hazardous waste during the 1970s through to 1985. The policy of the owner/operator of the landfill has been to dispose of only those wastes that are approved under the current solid waste permit and those approved jointly by PADEP, the Berks-Montgomery Municipal Authority, and the Landfill Engineer.

A Site Location Map is presented as Figure 1. A Site Layout Map is presented as Figure 2. Figure 3 shows the layout of the permanent and temporary soil gas monitoring points. Figure 4 depicts the locations of surface water samples collected.

In September 1997 the BSD Landfill was closed with the installation of a municipal solid waste landfill cover. The closure activities, which were performed by Solmax International, included the installation of a 30 mil (0.75 mm) poly vinyl chloride (PVC) liner over 1,600,000 ft^2 of the landfill with soil cover (thickness unknown at this time).

A Commonwealth of Pennsylvania court order against the Chief Executive Officer of the BSD Landfill was issued in September 1998. The order was in response to the failure to comply with the requirements of a 1997 PADEP Administrative Order. The court order required that a

qualified environmental consultant be retained to assess the leachate management, gas management, and capping systems of the BSD Landfill. The court order also required the completion of repairs and improvements required by the assessment to address environmentally harmful conditions by June 30, 1998.

The court order also required that quarterly groundwater monitoring resume no later than May 1, 1998 and continue thereafter. Requirements to sample raw and treated leachate were also imposed. Sampling was necessary to ensure consistency with the requirements of the Berks-Montgomery Municipal Authority wastewater treatment plant that receives the leachate. Arrangements were also to be made with the authority for the on-going full disposal of leachate.

According to a June 18, 1999 listing in the Montgomery County Enforcement Actions, the Chief Executive Officer of the BSD Landfill failed to comply with the September 1997 court order and allowed post-closure conditions at the landfill to deteriorate over several years. Necessary actions included maintenance of the landfill's leachate system and gas flare equipment as well as submitting documentation to PADEP outlining leachate treatment and groundwater monitoring activities.

According to a letter from Applied Geotechnical and Environmental Services (AGES) to PADEP dated June 18, 1998, an evaluation was performed of the landfill and its systems in accordance with the March 1998 Administrative Order. The evaluation contained the following description of the systems at the site:

- Leachate Management System – includes effluent pump house, air stripper, leachate treatment plant, clarifier and fixed film reactor, effluent lagoons A & B, raw leachate lagoon, and manholes.
- Gas Management System – includes gas burner, blower unit, and auto igniter.

The June 18, 1998 document also indicated that the owner of the landfill had excavated two trenches at the top of the landfill to recirculate leachate in the fall of 1995. In 1997, the BSD backfilled these two trenches.

Trichloroethene (TCE) was detected in groundwater in the 1980s at concentrations as high as 68 parts per billion (ppb) in MW-1 (the garage well). More recent sampling events have shown a decrease in TCE concentrations (approximately 10 ppb). According to the Environmental Indicator determination prepared by PADEP, completed at the BSD Landfill in 2000, the TCE contamination is not related to the landfill operation. Groundwater sampling at the BSD Landfill has not been on-going (conducted by the facility) as required by PADEP according to Conshohocken PADEP staff. PADEP conducts Comprehensive Monitoring Evaluations (CMEs) at the facility on an annual basis.

In 2001 there were reports of leachate seeps and landfill gas emanating from the landfill. There is a potential for off-site exposures to occur, thus prompting the need for this Site Investigation and Engineering Evaluation.

Subsequent to the Site Investigation, Mr. Timothy Cherry of PADEP provided TtFW with his field notes which detail indoor air monitoring results PADEP collected in 2002 and 2003 from several homes located approximately 2,000 feet south and downgradient (and immediately adjacent) to the landfill. The readings were collected in the basements of the homes, which are constructed with a floating slab basement (concrete) with sumps approximately 18 inches deep. The results of these monitoring events are summarized below.

Address	Direction from Landfill (all downgradient)	Monitoring Date	Methane Concentration (%)	Oxygen Concentration (%)
127 Hawthorne Avenue	southwest	8/12/2002	0	20.9
131 Hawthorne Avenue	southwest	8/14/2002	0	20.9
139 Hawthorne Avenue	southwest	8/12/2002	0	20.9
1405 Penney Lane	south	8/14/2002	0	20
1409 Penney Lane	south	8/26/2002	0	21
205 Hawthorne Avenue	southwest	10/28/2003	0	not measured
205 Hawthorne Avenue	southwest	8/12/2002	0	20.9
209 Hawthorne Avenue	southwest	8/12/2002	0	20.9
213 Hawthorne Avenue	southwest	8/14/2002	0	20.9
217 Hawthorne Avenue	southwest	8/26/2002	0	21
221 Hawthorne Avenue	southwest	8/14/2002	0	20.9

PADEP determined that landfill gas was not affecting these off-site properties.

1.2 PROJECT DESCRIPTION

This project consisted of the collection of two surface water samples from the Minister Creek (adjacent to the north side of the site), landfill gas monitoring at 10 of the 35 (originally thought to be 50) existing gas monitoring points along the south side of the site previously installed via PADEP's Hazardous Site Cleanup Act (HSCA) program. Fifteen (15) landfill gas monitoring points (temporary points that were installed by a TtFW subcontractor) were also monitored in areas biased to locations where odors have been historically noted. An evaluation of the operation of the gas collection system, leachate collection/treatment system, and a visual inspection of the integrity of the landfill cover was performed.

2.0 SITE INVESTIGATION RESULTS

2.1 SURFACE WATER SAMPLING RESULTS

Two surface water samples were collected from the Minister Creek, which runs adjacent to the north side of the BSD Landfill for Target Compound List (TCL) Volatile Organic Compounds (VOCs) via method SW-846 8260B and Target Analyte List (TAL) metals via method SW-846 6010B. One sample was collected upgradient of the site and one was collected from a downgradient location. The following tables summarize the results.

Boyertown Sanitary Disposal Landfill
Surface Water - Minister Creek Summary of Detections - Metals

SITE SAMPLE ID DATE RESULT TYPE		EPA Drinking Water Regulations (MCLs)	PADEP Residential Medium-Specific Concentrations (MSCs) Used Aquifer, TDS<2,500	SWUPGRADIENT 09/23/2003 Primary	SWDOWNGRADIENT 09/22/2003 Primary	SWDOWNGRADIENT DUP 09/23/2003 Duplicate 1	FIELD BLANK 09/23/2003 Primary
Aluminum	(ug/l)	50*	200*	ND	ND	ND	ND
Antimony	(ug/l)	6	6	ND	ND	ND	ND
Arsenic	(ug/l)	10	50	ND	ND	ND	ND
Barium	(ug/l)	2000	2000	72.8 J	70.9 J	69.2 J	ND
Beryllium	(ug/l)	4	4	ND	ND	ND	ND
Cadmium	(ug/l)	5	5	ND	ND	ND	ND
Calcium	(ug/l)	–	–	41,000	41200	40300	ND
Chromium	(ug/l)	100	100	5.19 J	ND	1.54 J	ND
Cobalt	(ug/l)	–	730	ND	ND	ND	ND
Copper	(ug/l)	1000*	1000	ND	ND	ND	5.74 J
Cyanide	(mg/l)	200	200	ND	ND	ND	ND
Iron	(ug/l)	300*	300*	226	108	112	ND
Lead	(ug/l)	15	5	2.82 J	2.89 J	2.19 J	ND
Magnesium	(ug/l)	–	–	8830	9020	8810	ND
Manganese	(ug/l)	50*	50*	47.9	34.7	34.1	ND
Mercury	(ug/l)	2	2	0.05 J	0.05 J	0.05 J	ND
Nickel	(ug/l)	–	100	ND	ND	ND	ND
Potassium	(ug/l)	–	–	1980 J	2070 J	2010 J	ND
Selenium	(ug/l)	50	50	ND	ND	ND	ND
Silver	(ug/l)	100*	100	ND	ND	ND	ND
Sodium	(ug/l)	–	–	31500	31400	30700	ND
Thallium	(ug/l)	2	2	**7.93 J**	ND	ND	ND
Vanadium	(ug/l)	–	260	ND	ND	ND	ND
Zinc	(ug/l)	5000*	2000	11.5	11.8 J	ND	ND

NOTES:

– = No criteria available.

Criteria provided for chromium corresponds to total (if available) or hexavalent chromium.

* indicates criterion value corresponds to EPA "Secondary Drinking Water Regulations" and PADEP "Secondary Contaminants Medium-Specific Concentrations."

Bold indicates exceedance of MCLs and MSCs

Boyertown Sanitary Disposal Landfill
Surface Water - Minister Creek Summary of Detections
Semi-Volatile Organic Compounds (SVOCs)

SITE SAMPLE ID DATE RESULT TYPE		EPA Drinking Water Regulations (MCLs)	PADEP Residential Medium-Specific Concentrations (MSCs) Used Aquifer, TDS<2,500	SWUPGRADIENT 09/23/2003 Primary	SWDOWNGRADIENT 09/22/2003 Primary	SWDOWNGRADIENT DUP 09/23/2003 Duplicate 1	TRIP BLANK 09/23/2003 Primary	FIELD BLANK 09/23/2003 Primary
1,1,1-trichloroethane	(ug/l)	200	200	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	(ug/l)	--	0.3	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	(ug/l)	--	83000	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	(ug/l)	5	5	ND	ND	ND	ND	ND
1,1-Dichloroethane	(ug/l)	--	27	ND	ND	ND	ND	ND
1,1-Dichloroethylene	(ug/l)	7	7	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	(ug/l)	--	--	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	(ug/l)	70	70	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	(ug/l)	0.2	0.2	ND	ND	ND	ND	ND
1,2-Dibromoethane	(ug/l)		0.05	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	(ug/l)	600	600	ND	ND	ND	ND	ND
1,2-Dichloroethane	(ug/l)	5	5	ND	ND	ND	ND	ND
1,2-Dichloropropane	(ug/l)	5	5	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	(ug/l)	--	600	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	(ug/l)	75	75	ND	ND	ND	ND	ND
2-Butanone	(ug/l)	--	2800	ND	ND	ND	ND	ND
2-Hexanone	(ug/l)	--	5	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	(ug/l)	--	190	ND	ND	ND	ND	ND
Acetone	(ug/l)	--	3700	ND	ND	ND	ND	ND
Benzene	(ug/l)	5	5	ND	ND	ND	ND	ND
Bromodichloromethane	(ug/l)	80	100	ND	ND	ND	ND	ND
Bromoform	(ug/l)	80	100	ND	ND	ND	ND	ND
Bromomethane	(ug/l)	--	10	ND	ND	ND	ND	ND
Carbon disulfide	(ug/l)	--	1900	ND	ND	ND	ND	ND
Carbon tetrachloride	(ug/l)	5	5	ND	ND	ND	ND	ND
Chlorobenzene	(ug/l)	100	100	ND	ND	ND	ND	ND
Chlorobromomethane	(ug/l)	--	90	ND	ND	ND	ND	ND
Chloroethane	(ug/l)	--	230	ND	ND	ND	ND	ND
Chloroform	(ug/l)	80	100	ND	ND	ND	ND	ND
Chloromethane	(ug/l)	--	3	ND	ND	ND	ND	ND
cis-1,2-Dichloroethylene	(ug/l)	70	70	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	(ug/l)	--	6.6	ND	ND	ND	ND	ND
Cyclohexane	(ug/l)	--	5	ND	ND	ND	ND	ND
Dibromochloromethane	(ug/l)	80	100	ND	ND	ND	ND	ND
Dichlorodifluoromethane	(ug/l)	--	1000	ND	ND	ND	ND	ND
Ethylbenzene	(ug/l)	700	700	ND	ND	ND	ND	ND
Isopropylbenzene	(ug/l)	--	1100	ND	ND	ND	ND	ND
m&p-Xylenes	(ug/l)	--	--	ND	ND	ND	ND	ND
Methyl Acetate	(ug/l)	--	37000	ND	ND	ND	ND	ND
Methylcyclohexane	(ug/l)	--	--	ND	ND	ND	ND	ND
Methylene Chloride	(ug/l)	5	5	ND	ND	ND	ND	ND
Methyl tert-Butyl Ether	(ug/l)	--	20	ND	ND	ND	ND	ND
o-Xylene	(ug/l)	--	--	ND	ND	ND	ND	ND
Styrene	(ug/l)	100	100	ND	ND	ND	ND	ND
Tetrachloroethylene	(ug/l)	5	5	ND	ND	ND	ND	ND
Toluene	(ug/l)	1000	1000	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	(ug/l)	100	100	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	(ug/l)	--	6.6	ND	ND	ND	ND	ND
Trichloroethylene	(ug/l)	5	5	ND	ND	ND	ND	ND
Trichlorofluoromethane	(ug/l)	--	2000	ND	ND	ND	ND	ND
Vinyl chloride	(ug/l)	2	2	ND	ND	ND	ND	ND

NOTES:

-- = No criteria available.

value for 1,3-Dichloropropene

EPA Drinking Water Regulations (MSCs).

The surface water samples were collected directly into the sample bottles from the surface water. No additional equipment was required, eliminating the need for decontamination.

Appropriate QC samples were also collected to evaluate analytical results according to validation procedures stipulated in the USEPA's National Functional Guidelines for Inorganic Data Review (February 1994) and National Functional Guidelines for Organic Data Review (October 1999). QC samples (i.e., field duplicates and trip blanks) were collected at the rate specified in the Scope of Work provided by USEPA and PADEP.

The surface water samples were submitted to Chemtech of Englewood, New Jersey for analysis using SW-846 methods.

2.3.2 LANDFILL GAS MONITORING

TtFW (and its subcontractor) performed three tasks related to landfill gas monitoring.

TtFW's subcontractor, TPI, Incorporated, installed five clusters of temporary soil gas points on the southern side of the landfill where odors have been historically detected including during a site visit which PADEP, USEPA, and TtFW attended. At each of the five clusters, one soil gas point was installed to 2 feet below ground surface (bgs), one to 4 feet bgs, and one to 6 feet bgs.

TtFW's Geotechnical Engineer selected the locations for the temporary soil gas points based upon review of the as built drawings of the landfill and the assumed depth of waste and cover material.

Each temporary soil point was monitored with a Landtec GA-90, Photoionization Detector (PID), and a PID MiniRae. The Landtec GA-90 was used to measure methane, carbon dioxide, and oxygen, the PID MiniRae was used to measure hydrogen sulfide, and the PID was used to measure total VOCs.

The temporary soil gas monitoring points were installed on April 20, 2004 on the southern portion of the landfill using a track-mounted pneumatic hammer drill to advance a 1-inch diameter stainless steel coring bit to the specified depth. Approximately 2 inches of coarse sand were placed in the bottom of the borehole prior to installing the vapor monitoring probe. The probe consisted of a pre-cut length of schedule 40 PVC pipe with a slotted bottom portion. The annular space between the probe and the borehole was backfilled to approximately 2 inches below ground surface with coarse sand. The remainder of the hole was filled with hydrated bentonite to prevent intrusion of atmospheric gas through the drive hole during sampling. Once each temporary soil gas point was complete, a PVC cap was placed on top of the point to allow soil gas to accumulate within the PVC piping and equilibrate to the existing surrounding vapor concentrations.

The field team returned to the site on April 21, 2004 to monitor the temporary soil gas points, as well as the permanent points, which were installed previously by PADEP. Each of the permanent (every 5th point) and temporary landfill gas monitoring locations was monitored

approximately every three hours. A set of baseline data was also collected from every permanent soil pint installed by PADEP.

TtFW's Work Plan indicated that soil gas points were labeled as follows:

Sampling Point	Soil Gas Point Identification		
	Surface Landfill Gas (0-2 feet)	Subsurface Landfill Gas (2-4 feet)	Subsurface Landfill Gas (4-6 feet)
HSCA Monitoring Points	HSCA-01-0-2	HSCA-01-2-4	HSCA-01-4-6
Temporary Monitoring Points	TEMP-01-0-2	TEMP-01-2-4	TEMP-01-4-6

However, during the field activities, PADEP provided TtFW with a map depicting the permanent soil gas points that were installed via PADEP's HSCA program and their designations. Therefore, the permanent soil gas monitoring points have been labeled in accordance with the PADEP identification system. Figure 3 depicts the locations of the permanent and temporary soil gas monitoring points.

The following table summarizes the descriptions of the soil borings associated with the temporary soil gas monitoring points installed by TPI on April 20, 2004:

Soil Gas Monitoring Point	Description of Soil
TEMP-01-0-2	0 to 6 inches - top soil 6 to 24 inches - clay like soils
TEMP-01-2-4	0 to 6 inches – top soil 6 inches to 3 feet – clay like soils 3 feet to 3 feet 3 inches – waste (observed what appeared to be paper and cloth)
TEMP-01-4-6	Due to the fact that waste was encountered in the previous boring, this boring was not advanced.
TEMP-02-0-2	0 to 6 inches - top soil 6 inches to 2 feet - clay like soils
TEMP-02-2-4	0 to 6 inches - top soil 6 inches to 18 inches - clay like soils 18 inches to 24 inches – shale and clay 24 inches to 4 feet – clay like soils
TEMP-02-4-6	4 feet to 4 feet 6 inches - waste (observed what appeared to be paper and cloth)
TEMP-03-0-2	0 to 7 inches – top soil 7 inches to 2 feet – clay like soils
TEMP-03-2-4	0 to 7 inches – top soil 7 inches to 4 feet – clay like soils
TEMP-03-4-6	4 feet to 5 feet 2 inches – clay like soils 5 feet 2 inches to 6 feet - waste (observed what appeared to be paper and cloth)

Soil Gas Monitoring Point	Description of Soil
TEMP-04-0-2	0 to 7 inches – top soil 7 inches to 2 feet – clay like soils
TEMP-04-2-4	2 feet to 3 feet 2 inches – clay like soils and fill 3 feet 2 inches to 4 feet – moist clay like soils
TEMP-04-4-6	4 feet to 5 feet 2 inches – clay like soils 5 feet 2 inches to 6 feet - waste (observed what appeared to be paper and cloth)
TEMP-05-0-2	0 to 8 inches – topsoil 8 inches to 2 feet – clay like soils and gravels
TEMP-05-2-4	0 to 8 inches – top soil 8 inches to 3 feet 8 inches – clay like soils 3 feet 8 inches to 4 feet - waste (observed what appeared to be paper and cloth)
TEMP-05-4-6	0 to 8 inches – top soil 8 to 18 inches – clay like soils and gravels 18 to 20 inches –gravels 20 inches to 6 feet – clay and rock 6 to 7 feet - waste (observed what appeared to be paper and cloth)

Soil gas readings were collected from the temporary soil gas points approximately every three hours on April 21, 2004.

Temporary Soil Gas Points

Soil gas monitoring data collected at the landfill are summarized in the following tables.

Soil Gas Point Identification	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Total VOCs (ppb)	Hydrogen Sulfide (%)	Carbon Monoxide (%)
TEMP01-0-2	0818	0	2.9	18	6.6	0	0
	1118	0	0.7	20.2	0	0	0
	1345	0	0.6	20.5	0	0	0
TEMP01-2-4	0823	85.6	38.5	0	4.0	4	6
	1120	88.9	40	0	0	4	7
	1348	81.7	39.1	0	1	4	10
TEMP02-0-2	0827	6.1	8.6	9.9	0	0	0
	1123	8.7	7.6	13.6	0	0	1
	1351	6.5	6.9	12.4	0	0	0
TEMP02-2-4	0830	85.0	39.3	0	4.4	7	5
	1125	82.9	40.0	0	5.7	8	10
	1353	81.7	40.4	0	5	8	10
TEMP02-4-5	0835	85.5	38.8	0	5.7	8	6
	1127	83.2	40.9	0	6.1	8	11
	1355	82.0	40.2	0	5.6	9	12

Soil Gas Point Identification	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Total VOCs (ppb)	Hydrogen Sulfide (%)	Carbon Monoxide (%)
TEMP03-0-2	0840	80.5	41.3	0	20	1	1
	1131	44.1	26.1	19.2	0	0	3
	1357	82.6	4.4	1.1	0	0	0
TEMP03-2-4	0844	74.5	43.6	0	15	0	20
	1134	45	33.6	7.2	0	0	25
	1400	38.0	26.5	9.2	0	0	15
TEMP04-0-2	0850	0	3.3	17.2	0.8	0	0
	1137	0	3.0	17.8	0	0	0
	1405	0	2.9	18.0	0	0	0
TEMP04-2-4	0853	0	4.0	10.5	0	0	0
	1139	0.3	5.9	6.8	1.8	0	0
	1407	0.9	6.7	7.3	0	0	0
TEMP04-4-6	0856	80.6	38.5	0	12.5	125	28
	1141	8.1	4.7	18.0	0	8	24
	1409	26.3	15.9	12.3	0	136	32
TEMP05-0-2	0902	0	4.4	17.7	4.5	0	0
	1145	0	2.1	19.5	0	0	0
	1413	0	1.1	20.3	0	0	0
TEMP05-2-4	0905	92.2	31.3	0	1.5	0	3
	1147	35.7	13.3	16.6	0	5	1
	1417	8.9	5.5	18.7	0	150	6
TEMP05-4-6	0909	7.2	3.9	18.2	2.9	0	0
	1150	0	0	21.0	0	0	0
	1419	0	0.1	20.9	0	0	0

Permanent Soil Gas Points – Baseline Readings

A set of baseline readings was collected from each of the permanent soil gas points prior to collecting readings approximately every 3 hours from approximately every fifth existing point, per the approved Work Plan on April 21, 2004. The baseline readings collected are as follows (the baseline also considered the first round of period monitoring for every permanent point):

Soil Gas Point Identification	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Total VOCs (ppb)	Hydrogen Sulfide (%)	Carbon Monoxide (%)
MP-01	0918	0	0	20.2	198	0	0
MP-50	0920	0	0	20.4	18.5	0	0
MP-100	0922	0	0	20.4	5.3	0	0
MP-150	0924	0	0	20.4	6.9	0	0
MP-200	0926	0	0	20.5	0	0	0
MP-250	0927	0	0	20.4	0	0	0
MP-300	0928	0	0	20.4	0	0	0
MP-350	0930	0	0	20.5	0	0	0

Soil Gas Point Identification	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Total VOCs (ppb)	Hydrogen Sulfide (%)	Carbon Monoxide (%)
MP-400	0931	0	0	20.3	0	0	0
MP-450	0933	0	0	20.4	4	0	0
MP-500	0935	0	0	20.3	2.5	0	0
MP-550	0936	0	0	20.4	0	0	0
MP-575	0938	0	0.5	20.3	0	0	0
MP-600	0940	0	0	20.5	0	0	0
MP-625	0941	0	4	5.7	211	0	0
MP-650	0943	0	0	20.4	0	0	0
Additional pt	0945	2.5	34	20	0	0	0
MP-675	0950	8.8	11.4	1.9	5.9	0	1
MP-700	0953	0	0	20.5	0	0	0
MP-725	0954	0	0	20.5	0	0	0
MP-750	0956	5.7	0	20.3	0	0	1
MP-775	0958	4.4	24.6	0	0	0	4
MP-800	1005	0	0.4	20.2	0	0	0
MP-825	1008	0	0.3	20.5	2	0	0
MP-850	1010	0	0	20.7	3.9	0	0
MP-900	1012	0	0	20.7	12.3	0	0
MP-950	1014	0	0	20.7	0	0	0
MP-1000	1015	0	0	20.8	0	0	0
MP-1050	1016	0	0	20.8	0	0	0
MP-1100	1019	0	0	20.7	13	0	0
MP-1150	1020	0	0	20.8	0.8	0	0
MP-1200	1022	0	0.3	20.5	0.5	0	0
MP-1250	1024	0	0	20.8	9.9	0	0
MP-1300	1026	0	0	20.8	4.8	0	0
MP-1350	1028	0	0	20.8	0	0	0

The baseline readings summarized above are considered to be the first of three readings collected approximately every three hours.

Periodic Soil Gas Points - Periodic Monitoring Results

Soil Gas Point Identification	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Total VOCs (ppb)	Hydrogen Sulfide (%)	Carbon Monoxide (%)
MP-01	1154	0	0	20.8	0.8	0	0
	1425	0	0	21	0.6	0	0
MP-50	1157	0	0	20.8	6.4	0	0
	1430	0	0	20.8	1.2	0	0
MP-625	1202	0	4.5	5.1	1.6	0	0
	1437	0.2	5.5	3.8	1.8	0	0
MP-675	1204	7.5	15	3.4	0	0	0
	1440	7.6	14.8	5	0	0	1

Soil Gas Point Identification	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Total VOCs (ppb)	Hydrogen Sulfide (%)	Carbon Monoxide (%)
MP-700	1029	5	9.4	3.7	0	0	0
	1442	8.2	8.9	5.1	0	0	1
MP-775	1214	12.1	17.6	1.7	0	0	0
	1449	11.4	16.7	4.1	0	0	3
MP-800	1218	20.3	24.4	0	0	0	9
	1447	15.9	18.8	2.1	0	0	7
MP-900	1221	0	0	20.9	2.3	0	0
	1450	0	0	20.5	1.2	0	0
MP-1100	1225	0	0	21.1	9.1	0	0
	1453	0	0	20.6	9.2	0	0
MP-1250	1227	0	0	21.1	0.8	0	0
	1457	0	0	20.6	0.8	0	0

2.3.3 EVALUATION OF THE LANDFILL COVER AND SYSTEMS

PADEP has had prior concerns at the BSD Landfill with regard to leachate management, gas management, and capping systems of the landfill. A June 18, 1999 listing in the Montgomery County Enforcement Actions, noted that the Chief Executive Officer of the BSD Landfill allowed post-closure conditions at the landfill to deteriorate over several years. Necessary actions included maintenance of the landfill's leachate system and gas flare equipment as well as submitting documentation to PADEP outlining leachate treatment and groundwater monitoring activities.

Mechanical System Evaluation Findings and Recommendations

TtFW's Mechanical Engineer assessed the mechanical systems of the landfill during the April 20, 2004 site visit.

The original vapor recovery system was observed to be in disrepair along the south side of the landfill during the site visit. The system consists of various sections of above ground flexible corrugated HDPE (drainage tile) piping with some sections connected with duct tape. A portion of this piping was observed to be destroyed on the southern portion on the landfill; it appeared that the damage was caused by a vehicle being operated on the landfill. Fugitive emissions were noted in the vicinity of the piping, especially in the damaged areas.

The Shaw Group, an Interim and Remedial Response Services Contract (IRRSC) Contractor for PADEP was coincidentally on site during the Site Investigation. The representative reported that Shaw installed a vapor recovery system and leachate inceptor trench and collection system in the summer of 2003. These systems were not yet operational as a propane tank (to provide supplemental fuel for the methane recovery system) has not been installed. Shaw indicated that the installation of the propane tank should occur shortly. The Shaw representative also reported that PADEP instructed Shaw to install this new system and to leave the original vapor recovery system in place.

TtFW suspects that the system installed by Shaw will assist in the reduction of fugitive emissions from the original vapor recovery system. However, the piping associated with the original vapor recovery system should be repaired and properly maintained to prevent fugitive emissions from reaching the neighboring community (residential homes are located directly adjacent to the southern side of the landfill) and to prevent short-circuiting of the Shaw system. The current flexible corrugated HDPE piping of the existing system should be replaced with rigid PVC or HDPE piping to provide durability.

The original vapor recovery vacuum blower located near the northeast corner of the landfill was not observed to be operational during the site visit. Mr. Warren Frame, the owner of the BSD Landfill reported that there is not enough vapors being generated by the landfill to maintain the flame on the flair on a continuous basis. TtFW recommends that the amount of vapors being generated by the landfill system be investigated. Even though a flare may not be able to be consistently self-supportive by the landfill gas alone, there may be a substantial quantity to be operated with a supplemental fuel supply (i.e. propane).

The on-site leachate treatment plant appeared to be operational during the site visit and Mr. Frame indicated that he has maintained its operation for some time now. As long as the system remains in compliance with the township's Publicly Owned Treatment Works (POTW) discharge permit, the current treatment operations appear to be sufficient.

TtFW observed at least 2 feet of freeboard available in each of the three leachate ponds (one influent raw leachate pond and two treated leachate ponds) and several liner patches noticeable along the leachate collection and settling ponds. Therefore, it seems Mr. Frame is providing some degree of maintenance to the treatment plant equipment.

The overall design of the original leachate and vapor collection systems should be reviewed to determine if additional modifications are necessary to bring the landfill into compliance with appropriate regulations.

Geotechnical System Evaluation Findings and Recommendations

TtFW's Geotechnical Engineer assessed the geotechnical portion of the landfill during the April 20, 2004 site visit.

There is no security fence along most of the southern edge of the property and there are several large holes in the fence along other sections of the landfill. It should be considered that the security of the landfill be increased, potentially with a 6-foot high chain link fence with three rows of barbed wire along the top. The security fence is needed at least on the south side and part of the east side of the landfill. Once installed, this security measure must be maintained. This would help prevent trespassing and vandalism at the landfill. Mr. Frame indicated that an unauthorized vehicle driving on the landfill over the winter months caused the previously discussed damage to the original vapor recovery system piping.

Several seeps were observed along the southern side of the landfill. Seeps should not occur along a landfill unless: there is an insufficient leachate collection system, a discontinuity or break in the cap material, a new groundwater flow pattern which has caused excessive pressure at points along the landfill, or any combination of these problems. TtFW suspects that once the Shaw vapor recovery and leachate inceptor trench system is operational, some, if not all, of these issues may be alleviated.

During the Site Investigation, a residential property owner, located to the south of the BSD Landfill informed TtFW that he suspected run-off from the landfill was entering his property during rain events (as large quantities of water accumulate in his back yard). TtFW contacted the PADEP project officer, Mr. Timothy Cherry (in regard to Shaw's work) to alert him of this report. Mr. Cherry indicated that he has spoken to this resident in the past and that the Department has determined that surface water run-off is not attributable to the landfill property. PADEP suggested to the property owner that he contact the developer and/or township to discuss the drainage and grading issues.

While PADEP has determined that resident's problem is not caused by the landfill, a surface water collection system near the landfill's southern boundary should be installed in support of normal maintenance activities. There is currently no surface water retention system (i.e. trench drain) along this southern site boundary. The current peripheral road surrounding the landfill is not graded, stabilized with riprap or stone, nor is it passable in some areas during rain events. This roadway should be repaired and maintained to allow vehicular access around the perimeter of the landfill and to the leachate collection and vapor recovery systems.

However, TtFW does not believe there is enough space from the edge of the landfill to the existing fence line to install the drainage ditch and the appropriate access road. Therefore, TtFW recommends the installation of an "Arizona Crossing", which is a channel that combines the access road and the drainage ditch. The size of the channel should be 12 feet wide and 6 inches deep at the center. A 4-inch geocell should be placed in the channel filled with pea gravel to a height of 3 inches and the upper inch of the geocell shall be filled with concrete. This channel should be installed on the south side and part of the eastern side of the landfill. An example of this technology is presented as Appendix B (a TtFW project). Appendix C contains a Rough Order of Magnitude Cost for the installation of an "Arizona Crossing", based on Boyertown Landfill Site's specific characteristics.

Many low depressions were observed within the landfill due to the settlement of the waste. These low depressions should be filled with topsoil and hydroseeded to promote positive drainage of the storm water runoff. Ponding water was also observed in some areas of the landfill. These areas should also be filled and hydroseeded as this water will eventually percolate through the landfill cap.

3.0 CONCLUSIONS

Based on the field investigation and visual inspection of the landfill cover, several conclusions may be drawn as follows:

Overall, the landfill was considered to be in fair condition. The primary needs of the landfill are to have the proper security measures implemented (fencing installation and repairs) and a thorough review of the landfill design. A design review may identify additional problem areas or more cost effective solutions to the existing issues. Additionally, a peripheral access road and drainage swale need to be installed to facilitate access around the landfill and to be in compliance.

The leachate and vapor collection systems seem to be adequate, other than the maintenance issues previously discussed (i.e. repair/replacement of above ground piping). Once the Shaw system is placed on-line, some or most of the current issues with fugitive emissions and leachate seepage may cease. It is unknown as to what Shaw anticipates their system's effectiveness to be. The on-site treatment plant appears to operate adequately, which is proven through the absence of any violations by the POTW recently. The flare in the northeast property corner should be operated to ensure that any landfill gas that is generated, is being destroyed.

Based on surface water samples collected from Minister Creek, it does not appear that the landfill has had adverse impacts to surface water. There were no downgradient exceedances of USEPA drinking water regulations.

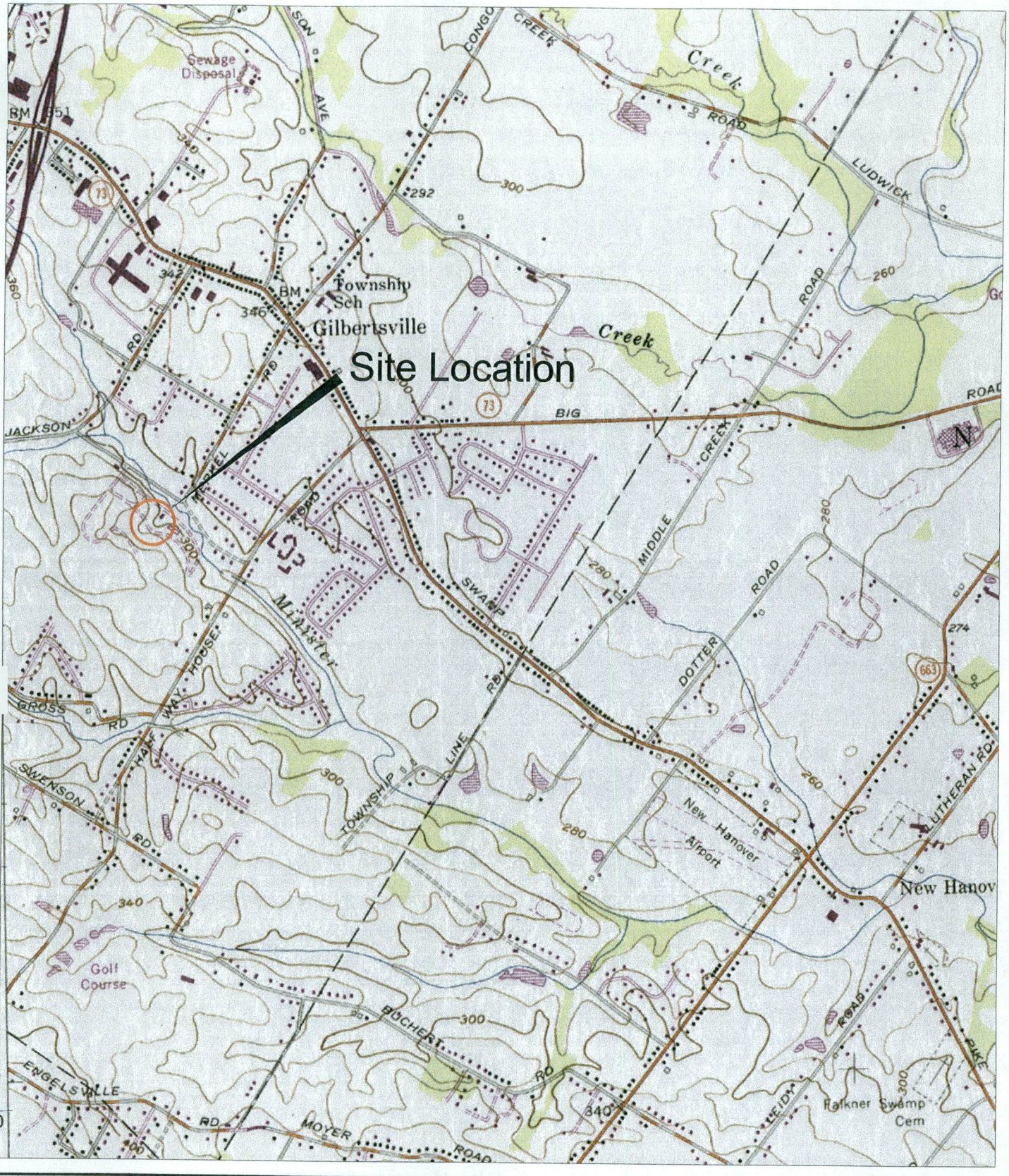
The visual soil identification, performed during the installation of the five sets of soil gas points, revealed that the thickness of the landfill soil cover varied from 3 feet to 6 feet. The type of soil material encountered during the drilling activities consists of mostly clay like materials and topsoil. This minimum thickness of 3 feet of soil cover on top of the waste should protect the human health and the environment.

A 6-foot high chain link fence with three rows of barbed wire along the top is recommended at least on the south side and part of the east side of the landfill.

A channel (Arizona Crossing©) that combines the access road and the drainage ditch is recommended at least on the south side and part of the east side of the landfill. The size of the channel should be 12 feet wide and 6 inches deep at the center. A 4-inch geocell should be placed in the channel filled with pea gravel to a height of 3 and the upper inch of the geocell should be filled with concrete.

Low depressions within the landfill boundary should be filled with topsoil and hydroseeded to promote positive drainage of the storm water runoff.

FIGURES



PENNSYLVANIA

Quadrangle Location Map

0 2000 4000 Feet

Source: U.S.G.S. Topographic Maps (7.5 Minute)
Sassamansville, PA Quadrangle

Commonwealth of Pennsylvania
Department of Environmental Protection

Boyertown Sanitary Disposal Landfill
Gilbertsville, PA

Figure 1
Site Location Map

TETRA TECH FW, INC.
Formerly Foster Wheeler Environmental Corporation

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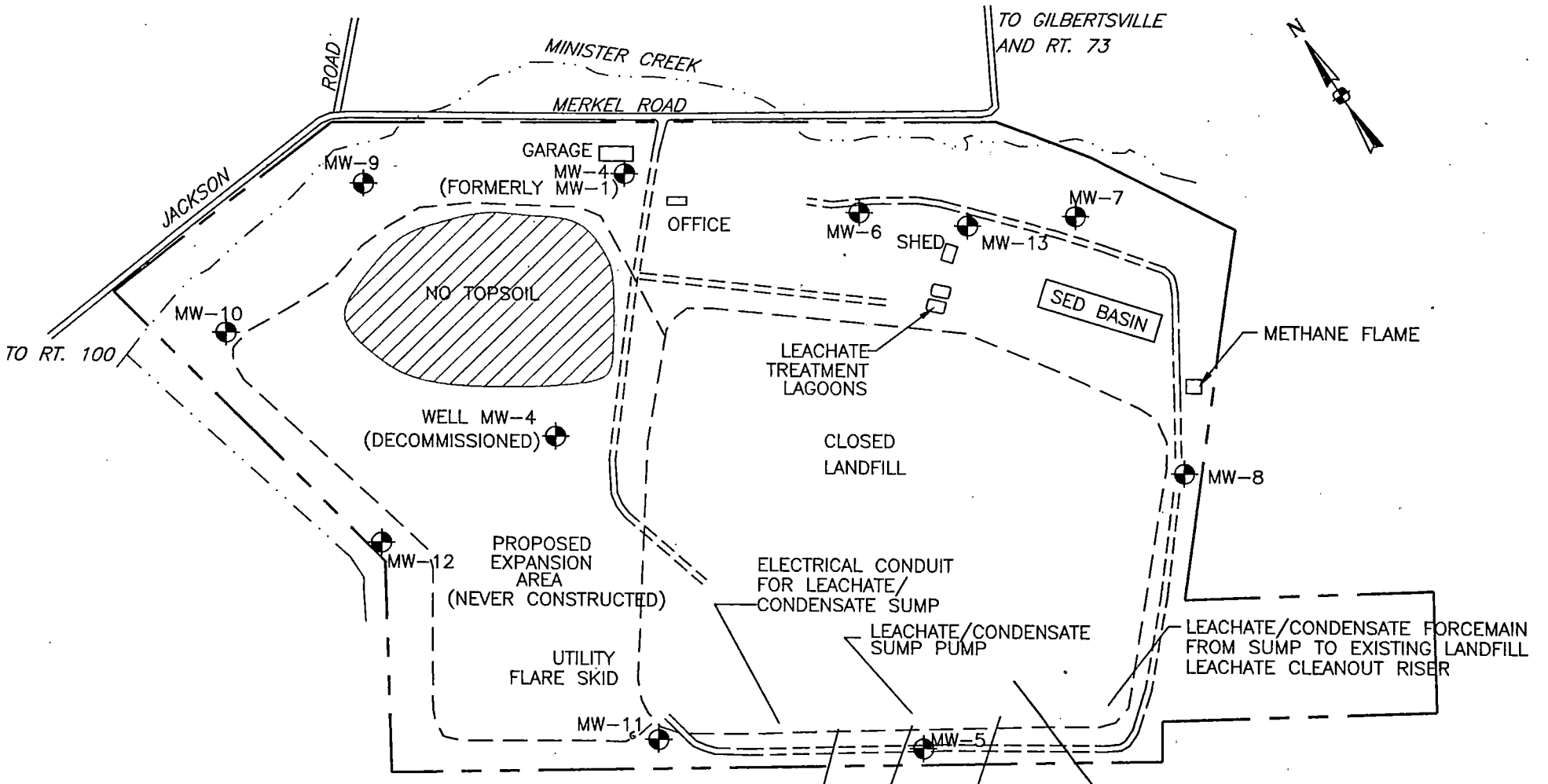

Commonwealth of Pennsylvania
Department of Environmental Protection

Boyertown Sanitary Disposal Landfill
Gilbertsville, PA

Figure 2
Site Layout

TETRA TECH FW, INC.

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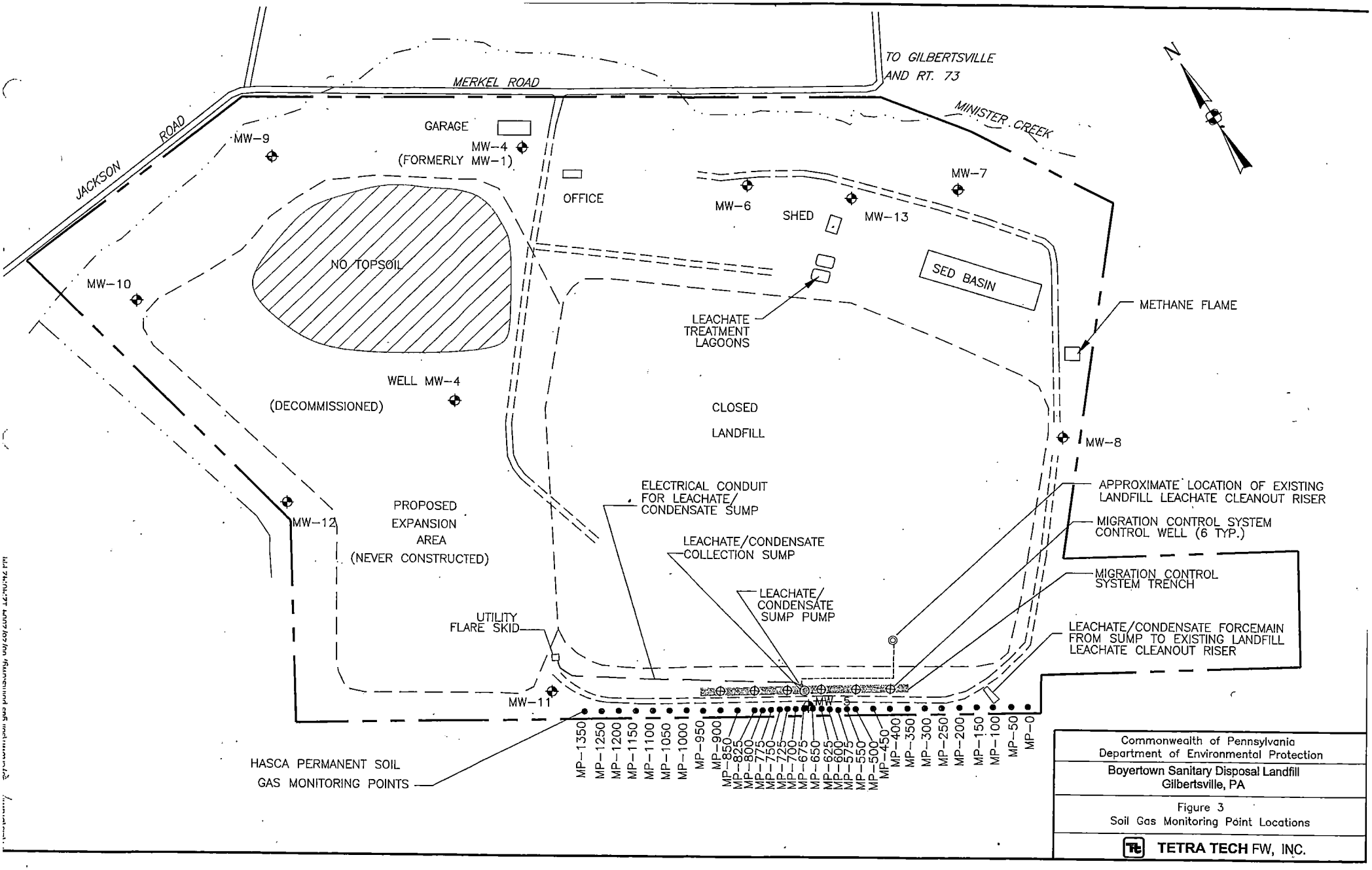
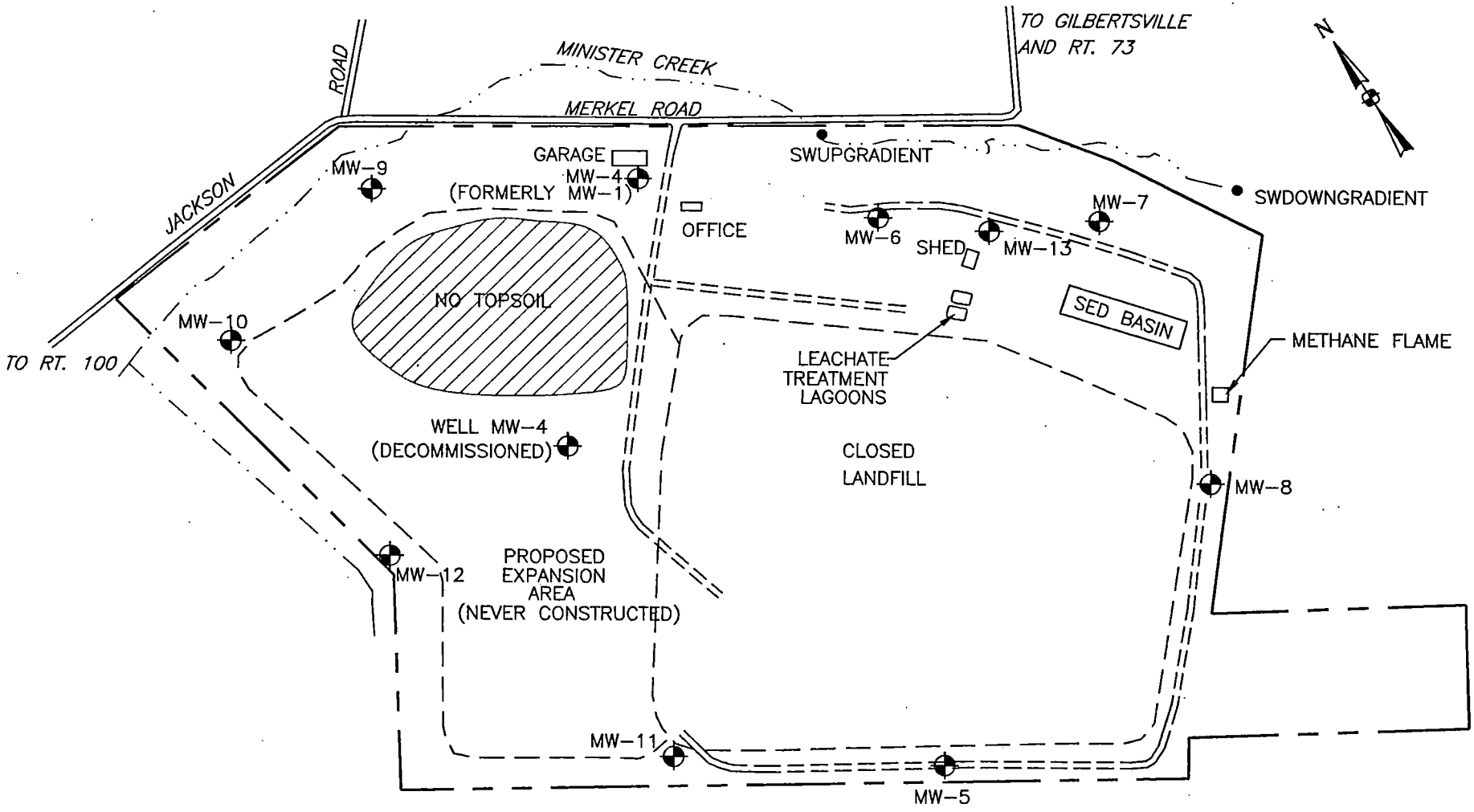


Commonwealth of Pennsylvania
Department of Environmental Protection

Boyertown Sanitary Disposal Landfill
Gilbertsville, PA

Figure 3
Soil Gas Monitoring Point Locations

TETRA TECH FW, INC.



NOT TO SCALE

Commonwealth of Pennsylvania Department of Environmental Protection
Boyertown Sanitary Disposal Landfill **Gilbertsville, PA**
Figure 4 Surface Water Sample Locations
TETRA TECH FW, INC.

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APPENDICES

APPENDIX A

Photographs

Photo #1 – View of damaged vapor recovery piping n the southern side of the landfill.

Photo #2 – View of tire marks on the southern side of the landfill.

Photo #3 – View of tire marks on the southern side of the landfill.

Photo #4 – View of damaged piping associated with the original vapor recovery systems on the southern side of the landfill.

Photo #5 – View of original vapor recovery system at southeast side of the landfill (not in operation).

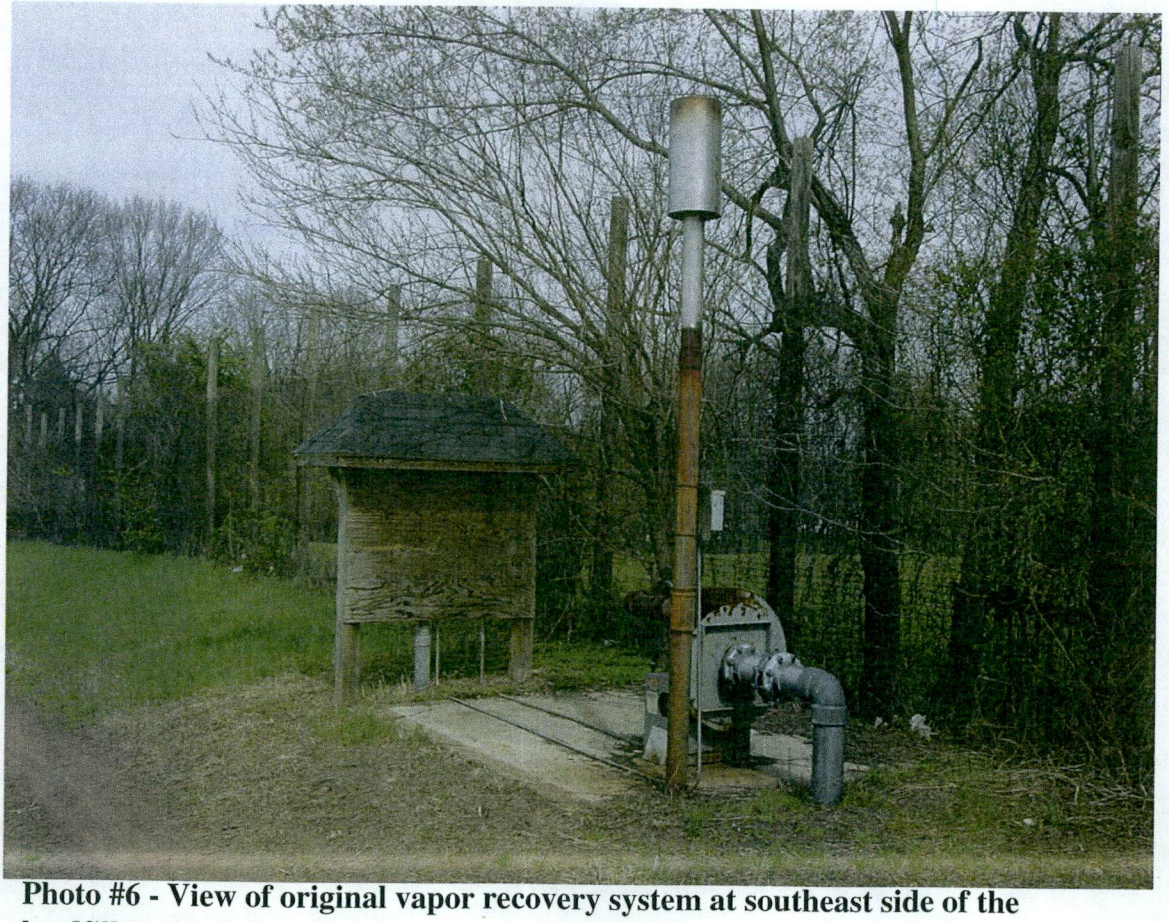

Photo #6 - View of original vapor recovery system at southeast side of the landfill (not in operation).

Photo #7 – View of surface water collection pond on northern side of the landfill.

Photo #8 – Site identification on Merkel Road.

Photo #9– View of vapor recovery and leachate inceptor system (front) installed by the Shaw Group in the summer of 2003 to address the southern side of the landfill.

Photo #10 – View of drilling subcontractor preparing for temporary soil gas monitoring point installation.

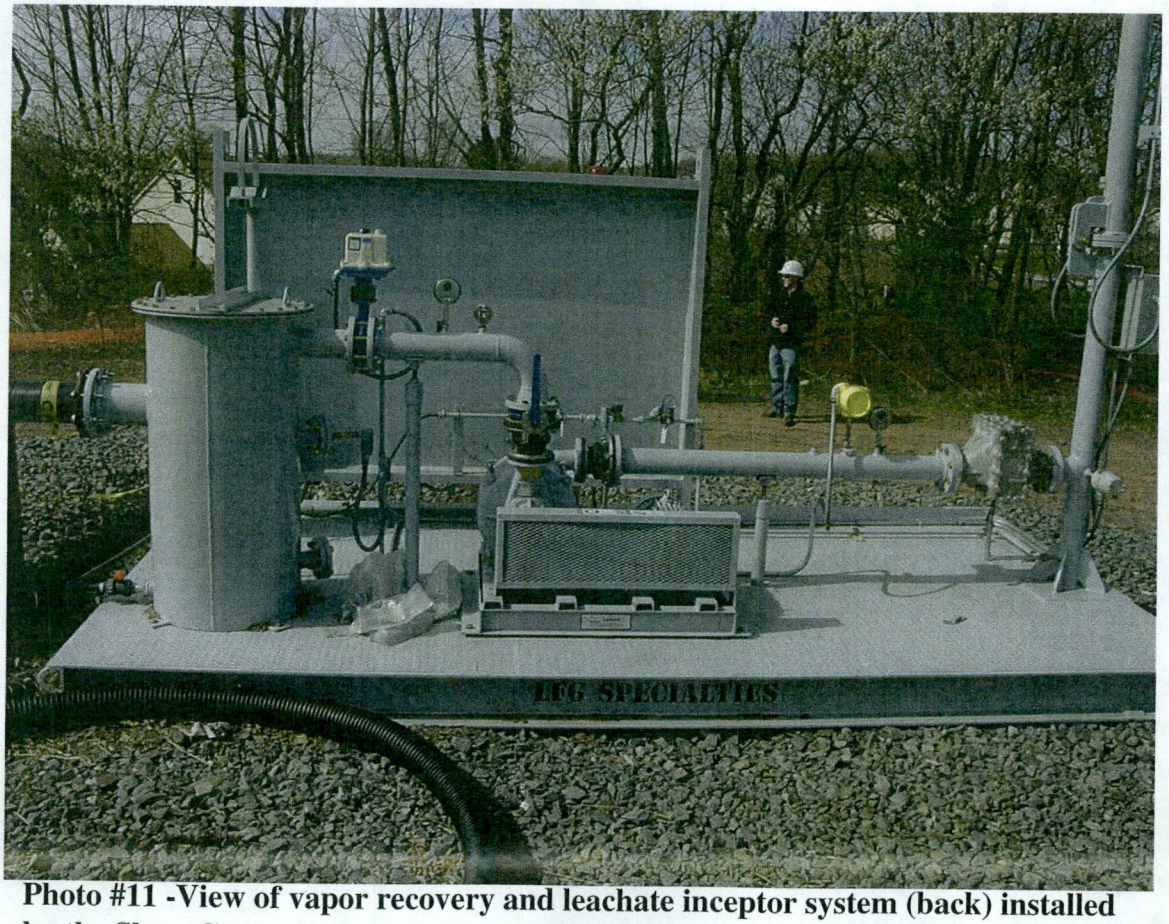

Photo #11 -View of vapor recovery and leachate inceptor system (back) installed by the Shaw Group in the summer of 2003 to address the southern side of the landfill.

Photo #12 – View of soil core from soil boring TEMP-01-0-2 on the southwest portion of the landfill

Photo #13 – Installation of temporary soil gas monitoring point TEMP-01-0-2.

Photo #14– View of soil from boring TEMP-01-0-2.

Photo #15 – View of soil from boring TEMP-01-0-2.

Photo #16– View of soil from boring TEMP-01-0-2.

Photo #17– View of residences located adjacent to south of the landfill.

Photo #18 – View of areas adjacent to the southern property boundary of the landfill.

Photo #19 – View of unvegetated area on the southern side of the landfill (towards the top).

Photo #20 – View of unvegetated area on the southern side of the landfill (towards the top).

Photo #21 – Stressed vegetation at the top f the landfill on the southern side.

Photo #22 – View of dirt access road, original vapor recovery piping, and stressed vegetation on the southern side of the landfill.

Photo #23 – view of installation of temporary soil gas points 04-0-2, 04-2-4, and 04-4-6.

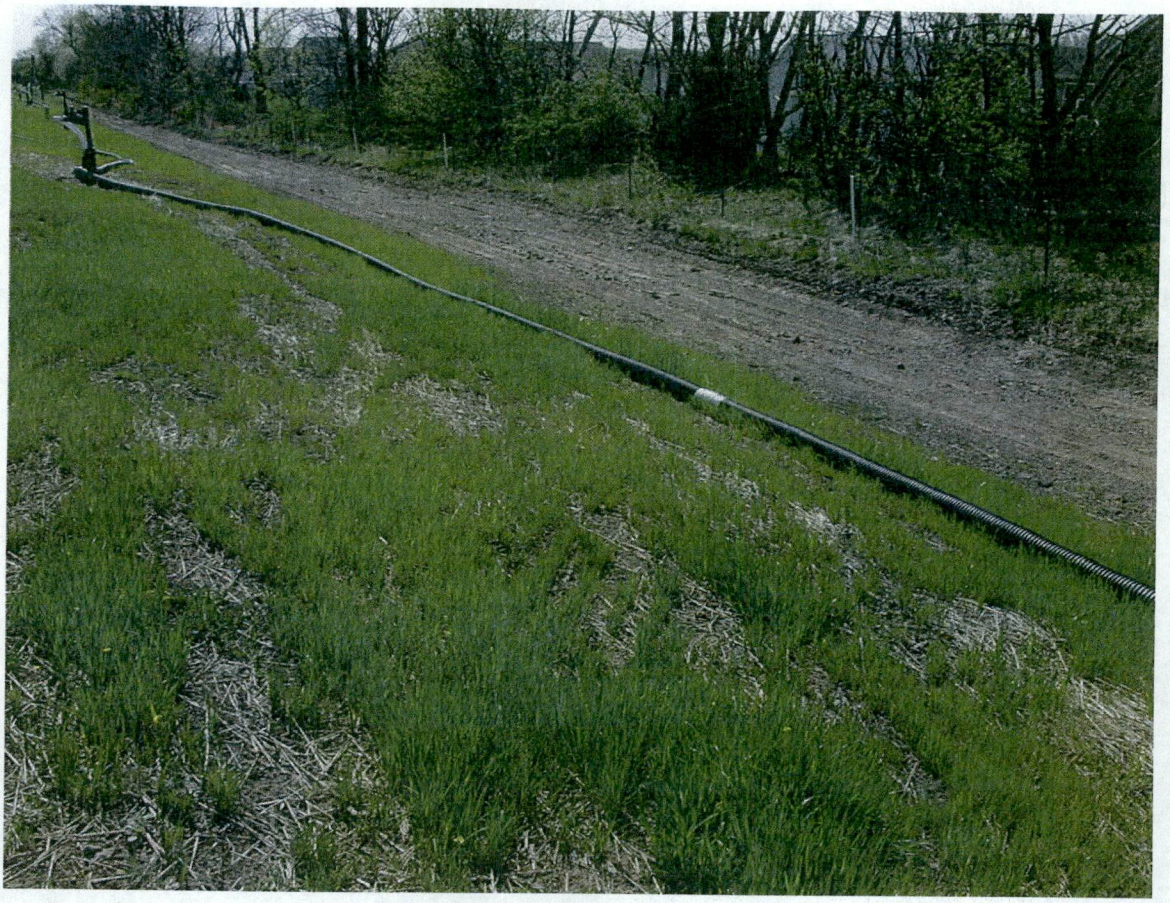

Photo #24 – View of original vapor recovery piping.

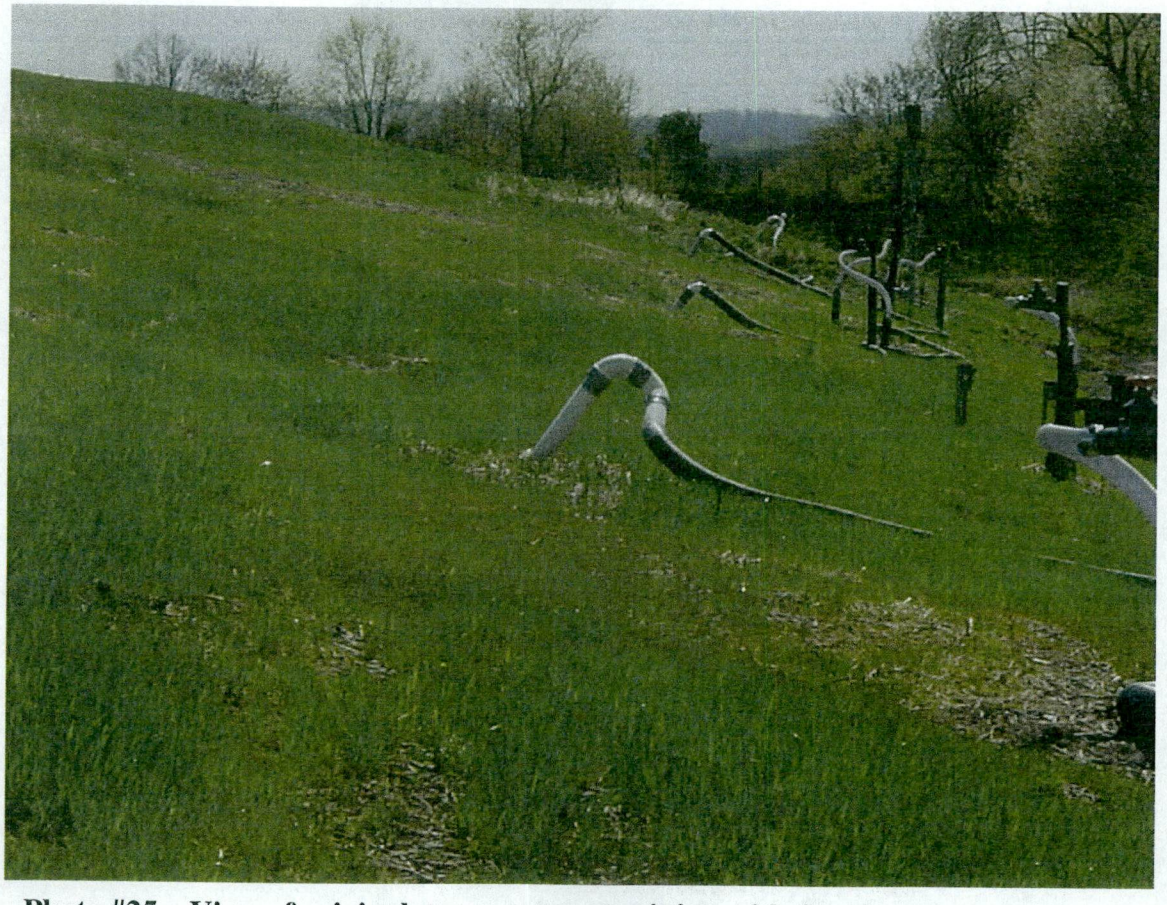

Photo #25 – View of original vapor recovery piping with duct tape connections.

Photo #26 – View of one of the 35 permanent soil gas points previously installed by PADEP.

Photo #27 – View of one of new vapor recovery points (vertical pipe).

Photo #28 – View of one of new vapor recovery points.

Photo #29 – View of one of new vapor recovery points.

Photo #29 – View of one of original vapor recovery points.

Photo #30 – View of acid and caustic tanks in the leachate treatment system that are no longer in use.

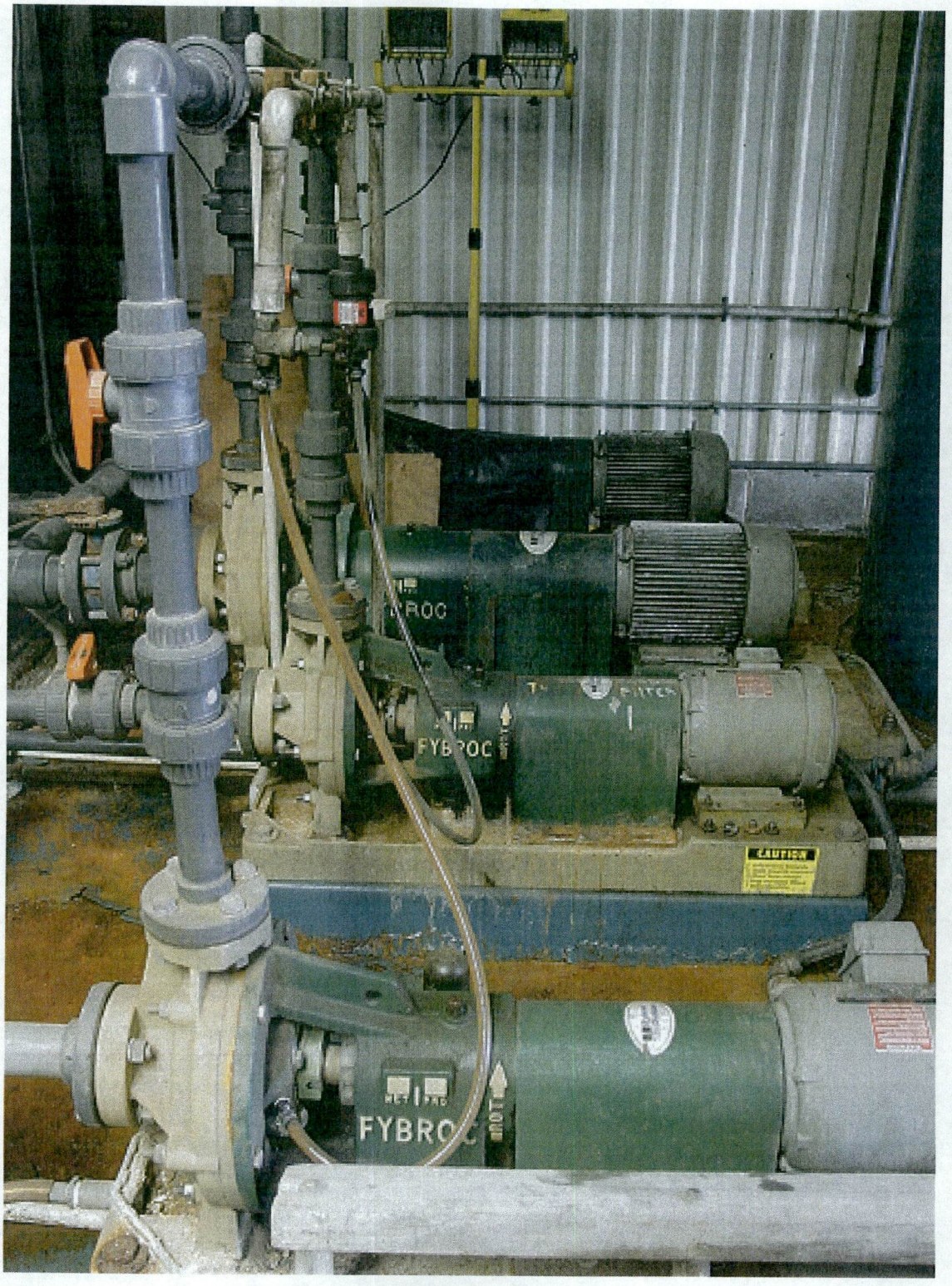

Photo #31 – View of leachate treatment system pumps.

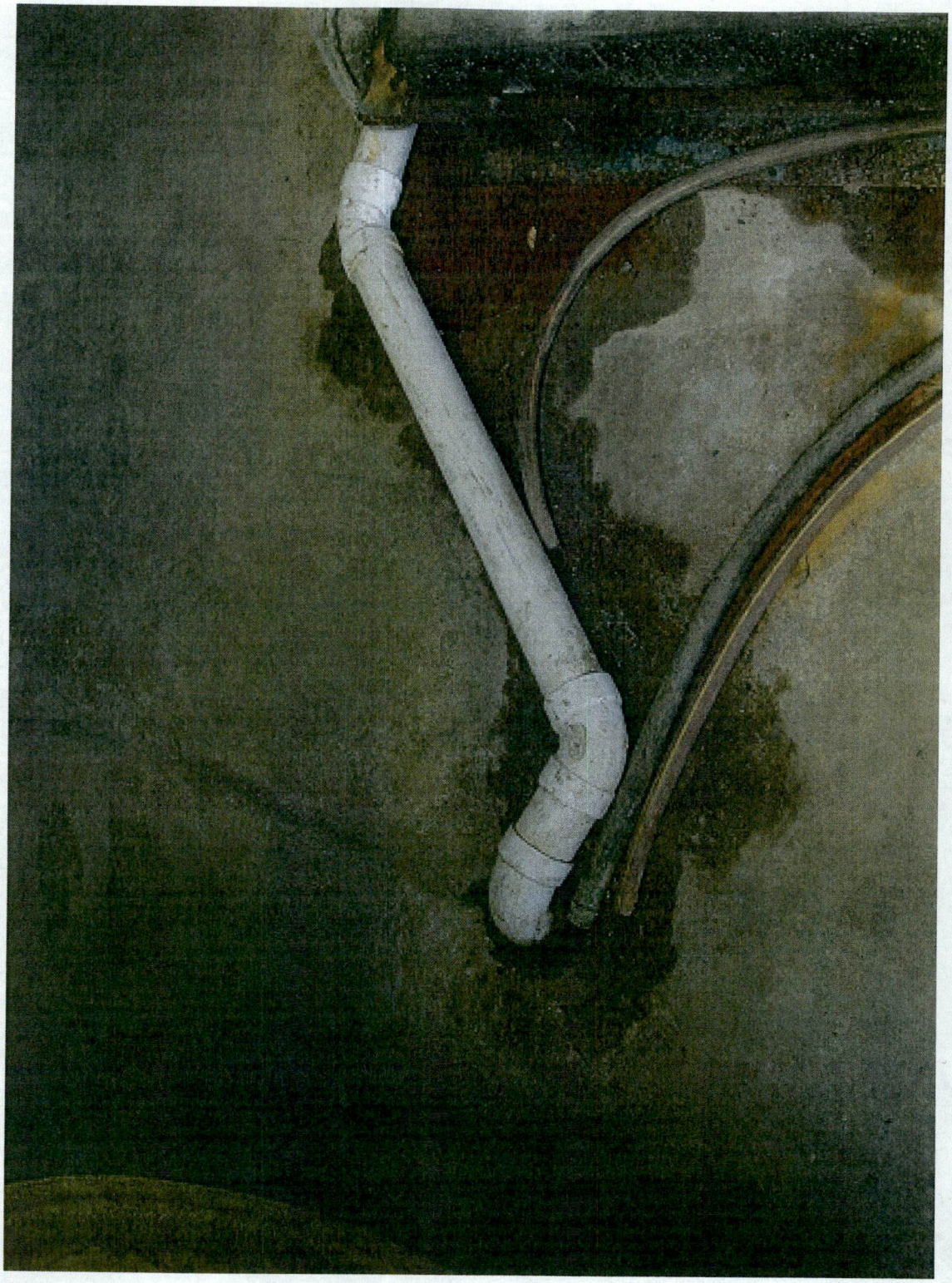

Photo #32 – View of discharge pipe to POTW.

Photo #33 – View of water leaking from leachate treatment system piping..

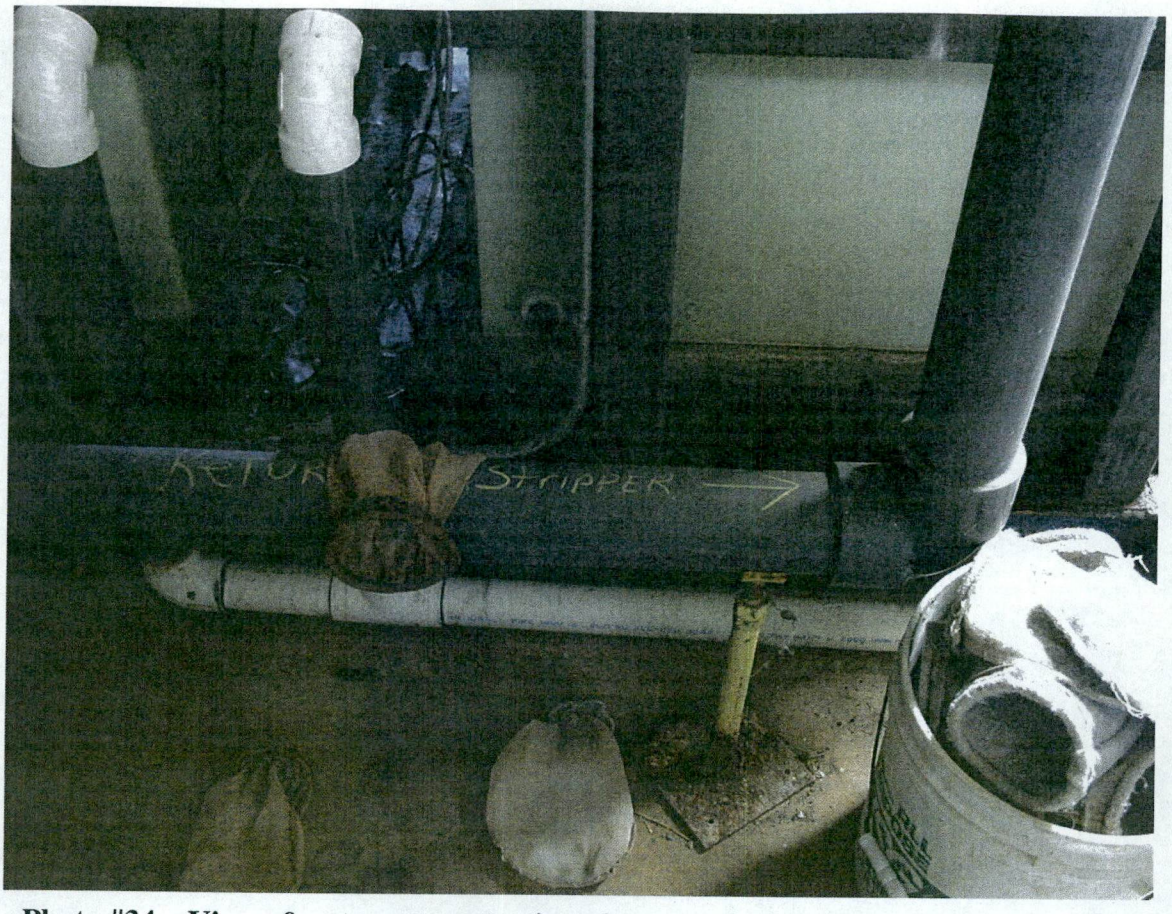

Photo #34 – View of water return to air stripper at the leachate treatment system.

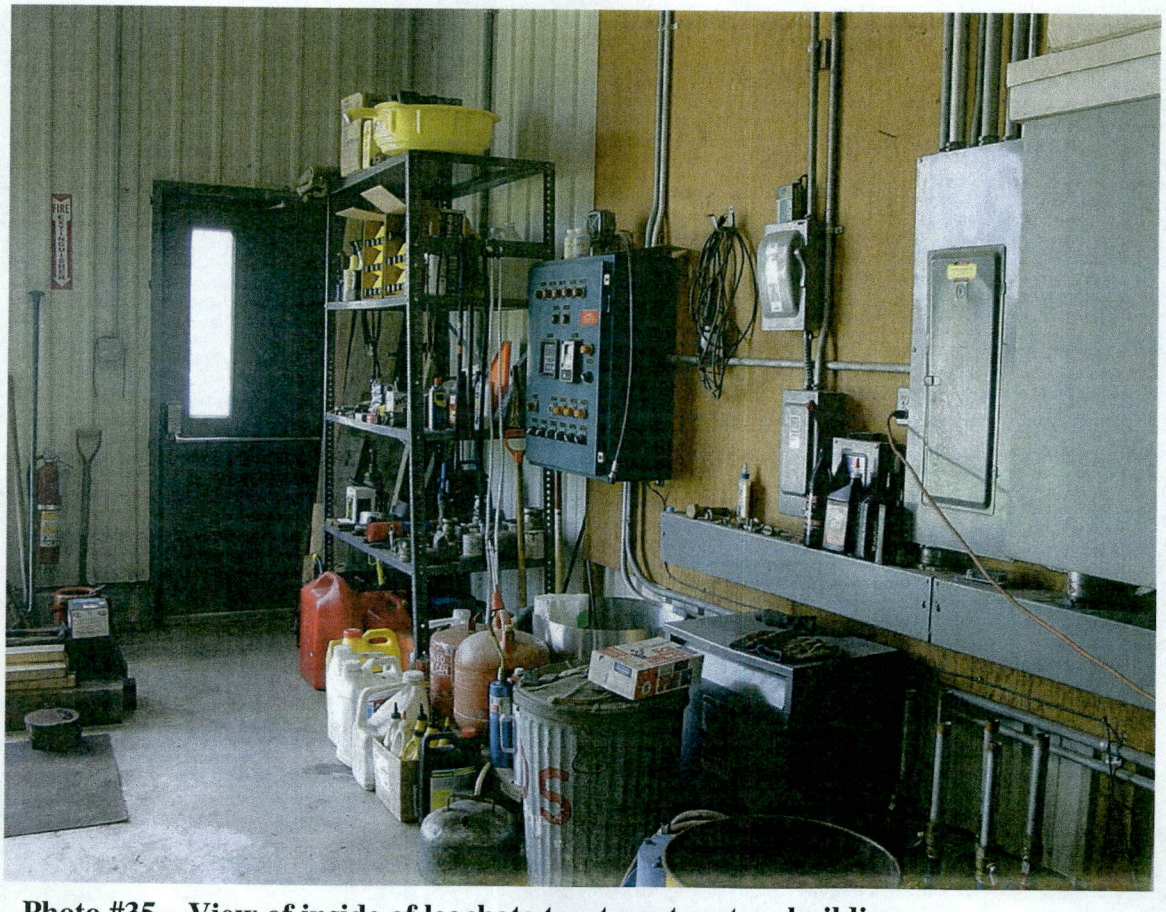

Photo #35 – View of inside of leachate treatment system building.

Photo #36 – View of air stripper associated with leachate treatment system.

Photo #37 – View of one of two leachate holding ponds (prior to treatment).

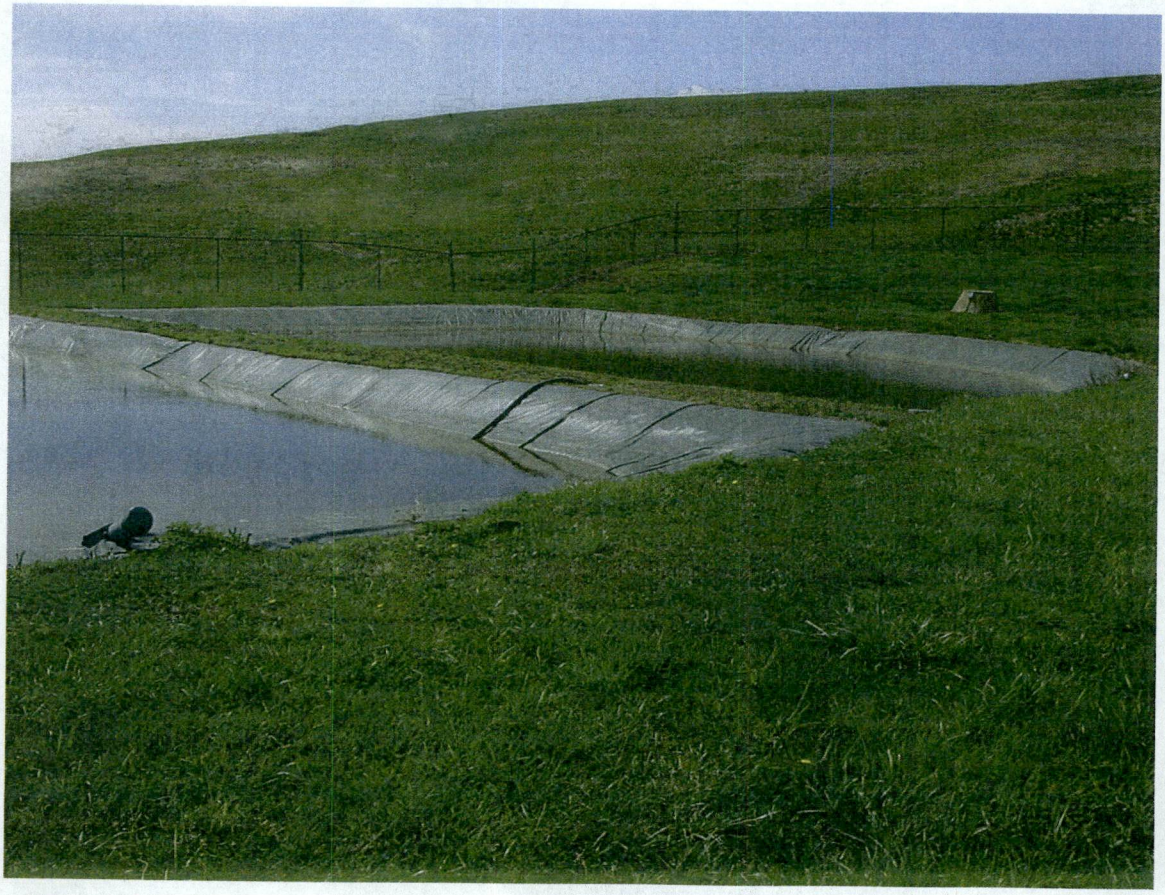

Photo #38 – View of the two leachate holding ponds (prior to treatment).

Photo #39 – Treated leachate pond prior to discharge to POTW.

Photo #40 – View of treated leachate pond, surface water pond, and one of two leachate holding ponds (left to right).

Photo #41 – View of leachate treatment system.

Photo #42 – View of patch on one leachate holding pond.

Photo #43 – View of treated leachate pond.